Test Flight Of The Space Shuttle Orbiter "Enterprise"

National
Aeronautics and
Space
Administration

NASA

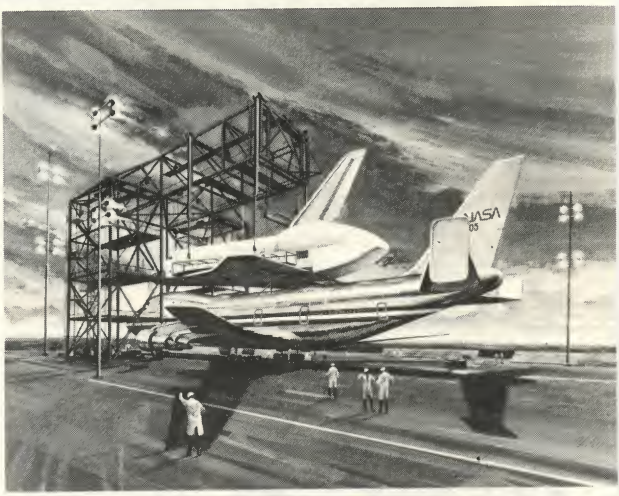
Space Shuttle Approach and Landing Tests

A new era in space transportation begins this year at the National Aeronautics and Space Administration's Dryden Flight Research Center with initial flight testing of the Space Shuttle Orbiter. These first tests consist of a series of low altitude approach and landing flights to verify the aerodynamic and flight control characteristics of the Orbiter, the reusable spaceplane of the next two decades.

This flight program is divided into three phases; the inert captive phase during which the Orbiter will simply ride, unmanned, on the back of the 747; the captive active phase in which the Orbiter will be manned but not released; and the free flight phase when the Orbiter will be manned and released.

The approach and landing tests will be conducted at Dryden, which is located at Edwards Air Force Base, California. Edwards has a paved runway 15,000 feet (4572 meters) long by 300 feet (91.4 meters) wide in addition to extremely long and wide dry lakebed runways.

Orbiter spacecraft ***Enterprise*** is hoisted in the mate/demate facility for attachment to mating struts on the Boeing 747 carrier aircraft.



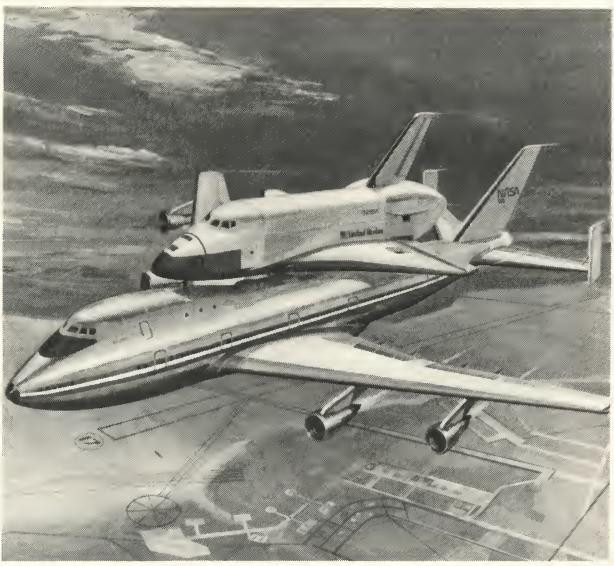
Phase 1

Phase 1 begins with taxi tests with the Orbiter atop the carrier aircraft, and proceeds to six flights which will carry the Orbiter to altitudes of 25,000 feet (7620 meters). These tests will check the performance, stability and control, and general safety of the two-aircraft combination.

Phase 2

During the six captive flights of Phase 2, two NASA astronauts will be aboard the Orbiter to help verify the most favorable separation techniques, refine crew procedures and evaluate the operation of the Orbiter's integrated systems.

Like the Roc in the legend of Sinbad, the carrier aircraft boosts ***Enterprise*** into the air—first for captive aerodynamic flight measurements, and later for gliding flights back to the runway in test of the Orbiter's landing system and handling characteristics. The carrier aircraft will also serve as a ferry for moving Orbiters from the West Coast to Kennedy Space Center for orbital launches.

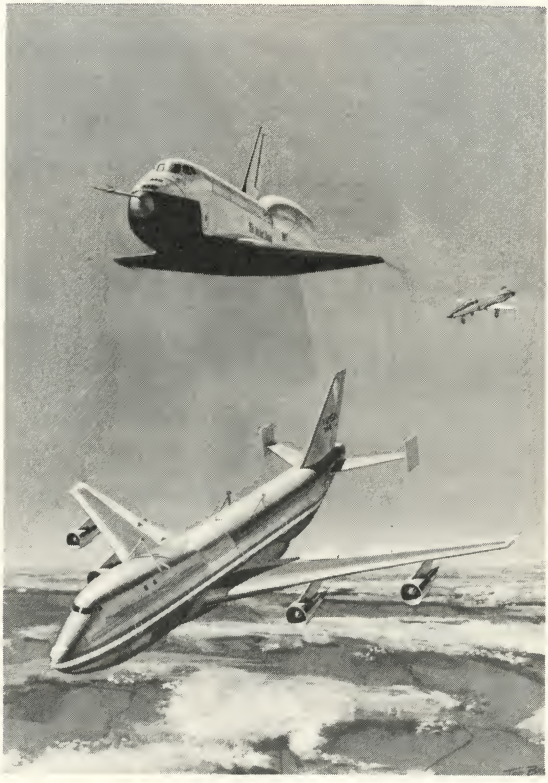


Phase 3

Eight free flights are scheduled for Phase 3. For the final three flights the tail cone installed around the main engine nozzles to improve aerodynamic performance during testing will be removed. The Orbiter will be released from the carrier aircraft at altitudes in the vicinity of 22,000 feet (6705 meters) and flown "dead stick" or unpowered, to landings on the runways at Edwards Air Force Base.

All approach and landing testing is scheduled for completion by early 1978.

In mid-1977, ***Enterprise*** will leave the protection of the carrier aircraft for steep gliding flights to the Dryden Flight Research Center runways as the astronaut crew proves her ability to fly in the atmosphere. ***Enterprise*** will touch down at more than 200 miles per hour.



The Carrier Aircraft

The Boeing 747 Shuttle Carrier Aircraft was purchased by NASA in the summer of 1974 and modified at the manufacturer's plant in Everett, Washington. The 231-foot-long (70.4 meters) aircraft has had the majority of its seats and passenger accommodations replaced by equipment and instruments required for the Orbiter test flights, and has been reinforced as necessary to compensate for the weight and stresses of the Orbiter. Three struts or pylons, two aft and one forward, have been added to the top of the 747 to which the Orbiter will be attached with explosive bolts for quick release at the required time. This special airplane will be used for the approach and landing tests and to ferry the Orbiters from the assembly plant to test and launch locations as necessary.

The first landing approach has to be right—there is no "going around" as ***Enterprise*** is lined up for landing on the runway and dry lakebed. The Orbiter's landing gear will be lowered a few short seconds prior to touchdown. Orbiters returning from orbital missions will land on runways at Kennedy Space Center and at Vandenberg AFB in California.

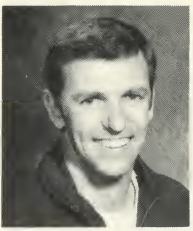
Space Shuttle Orbiter Crews

The two 2-men crews chosen by NASA for the Space Shuttle Approach and Landing Test (ALT) flights are: Fred W. Haise, Jr., commander, and Gordon Fullerton, pilot; Joe H. Engle, commander, and Richard H. Truly, pilot. Haise and Fullerton are scheduled for the first ALT mission.

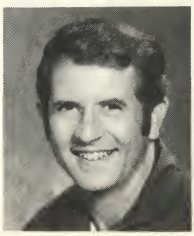
The crews train for flights using a NASA T-38 aircraft with special speed brake, a modified twin-jet Gulfstream II (known as the Shuttle Training Aircraft), the Shuttle Procedures Simulator, and the Orbiter Aeroflight Simulator.

HAISE, 43 (civilian), commander of the first crew, was selected for the astronaut program in April 1966. He was backup lunar module pilot for Apollo 8 and 11, lunar module pilot for Apollo 13, and backup commander for Apollo 16.

FULLERTON, 40 (Lieutenant Colonel, USAF), pilot of the first crew, was one of the USAF Manned Orbiting Laboratory Program crewmen selected for the astronaut program in September 1969. He was a member of the support crews for the Apollo 14 and 17 missions.



ENGLE, 44 (Colonel, USAF), commander of the second crew, was selected for the astronaut program in April 1966. He was a member of the astronaut support crew for Apollo 10 and the backup lunar module pilot for the Apollo 14 mission. He made 16 flights in the X-15 rocket-powered research aircraft while a USAF test pilot at Edwards AFB.

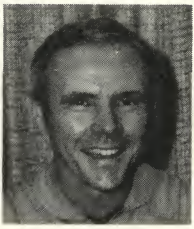


TRULY, 39 (Commander, USN), pilot for the second crew, was one of the USAF Manned Orbiting Laboratory Program crewmen selected for the astronaut program in September 1969. He was a member of the support crew for all three manned Skylab missions.

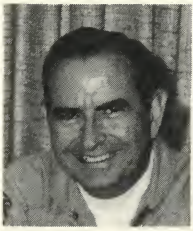
747 Carrier Aircraft Crew

Crew members for the 747 carrier aircraft are Fitzhugh L. Fulton, Jr., and Thomas C. McMurtry, pilots; Victor W. Horton and Louis E. Guidry, Jr., flight test engineers. Fulton, McMurtry and Horton are from the NASA Dryden Flight Research Center and Guidry is a flight engineer from the NASA Johnson Space Center.

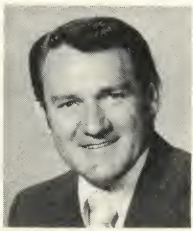
Fulton



McMurtry



Horton



Guidry

Fulton is a veteran multi-engine test pilot with wide experience as a launch pilot. He was launch pilot for the X-15 and for manned lifting bodies, as well as on other experimental aircraft flight test programs. He was an XB-70 project pilot for NASA and the USAF. Currently Fulton is co-project pilot on the triple-sonic YF-12 flight research program.

McMurtry has been flying experimental aircraft for NASA since 1967. As project pilot on the Supercritical Wing, he made the first flight with the new airfoil shape. He has flown as co-project pilot on the Digital Fly-by-Wire aircraft and the Supercritical Wing F-111, and as co-project pilot on NASA's 990 and C-141 multi-engine aircraft.

Horton is flight test engineer on the YF-12 at DFRC and has flown as launch-panel operator of the B-52 air-launch aircraft. Guidry of JSC has flown as test engineer on the C-135 Zero-G studies and the C-130 Earth Resources aircraft.

The Space Shuttle System

The Space Shuttle System is composed of the Orbiter, an external tank that contains the fuel and oxidizer to be used by the Orbiter's three main engines, and two solid rocket boosters. The Orbiter and boosters are reusable; the external tank is expended on each launch.

The Orbiter is the vehicle which will carry the crew and the payloads into space. With an empty weight of 150,000 pounds (68,000 kilograms), a length of 122 feet (37.2 meters) and a wingspan of 78 feet (23.8 meters), it is about the size of a medium-range jetliner. It can deliver to orbit payloads up to 65,000 pounds (29,484 kilograms) in its 15- by 60-foot (4.5- by 18-meter) cargo bay, and return from space with payloads of up to 32,000 pounds (14,515 kilograms). Each Orbiter is designed to perform these tasks a minimum of 100 times.

The Enterprise

Enterprise, the Orbiter to be used in the Dryden flight test program, is the first production article of the Shuttle program to come off the assembly line.

It was named by public demand for the "starship" in the TV series *Star Trek*, which in turn derived it's name from two great aircraft carriers of the U.S. Navy. The *Enterprise* has been under construction since June 19, 1974. Its principal parts come from many aerospace contractors across the nation. The crew module and aft fuselage were fabricated by the prime contractor, Rockwell International Space Division, Downey, California; the mid-fuselage (cargo bay) by General Dynamics, San Diego, California; the wings by the Grumman Aerospace Corporation of Bethpage, New York; and the tail assembly by the Fairchild Republic Company, Farmingdale, New York.

The *Enterprise* was transferred from the Rockwell International assembly plant at Palmdale to the NASA Dryden Center on January 31, 1977. After completion of the approach and landing tests, the first Orbiter will be ferried to the NASA Marshall Space Flight Center at Huntsville, Alabama, atop a specially configured Boeing 747 for extensive ground vibration tests. It will return to Palmdale early in 1979 to prepare for its first orbital flight, and be ferried to the launch facility at the Kennedy Space Center in March of 1981. The first actual orbital mission of the Space Shuttle, scheduled for March of 1979, will utilize the still un-named second Orbiter.